

## **Application of Spaceborne Scatterometer for Mapping Freeze-Thaw State in Northern Landscapes as a Measure of Ecological and Hydrological Processes**

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Landscape freeze/thaw transitions coincide with marked shifts in albedo, surface energy and mass exchange, and associated snow dynamics. Monitoring landscape freeze/thaw dynamics would improve our ability to quantify the interannual variability of boreal hydrology and river runoff/flood dynamics. The annual duration of frost-free period also bounds the period of photosynthetic activity in boreal and arctic regions thus affecting the annual carbon budget and the interannual variability of regional carbon fluxes. In this study, we use the NASA scatterometer (NSCAT) to monitor the temporal change in the radar backscatter signature across selected ecoregions of the boreal zone. We have measured vegetation tissue temperatures, soil temperature profiles, and micrometeorological parameters *in situ* at selected sites along a north-south transect extending across Alaska from Prudhoe Bay to the Kenai Peninsula and in Siberia near the Yenisey River. Data from these stations have been used to quantify the scatterometer's sensitivity to freeze/thaw state under a variety of terrain and landcover conditions. Analysis of the NSCAT temporal response over the 1997 spring thaw cycle shows a 3 to 5 dB change in measured backscatter that is well correlated with the landscape springtime thaw process. Having verified the instrument's capability to monitor freeze/thaw transitions, regional scale mosaicked data are applied to derive temporal series of freeze/thaw transition maps for selected circumpolar high latitude regions. These maps are applied to derive areal extent of frozen and thawed landscape and demonstrate the utility of spaceborne radar for operational monitoring of seasonal freeze-thaw dynamics and associated biophysical processes for the circumpolar high latitudes.

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